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The Team Spirit

We have been re-reading Dr. H. W. Gillett's Edward Williams Lecture and recommend others to follow our example, for it contains the answer to many problems both current and post-war. It is essential for the student to bear in mind that the author's experience is associated with a vast continent where distances are great and competition for many lines is not on a national basis. These conditions obviously add force to the general underlying argument of the Paper, even though it be devoted in the main to technical co-operation by the formation of groups. They do not, however, detract in the least from the obvious necessity of applying the conditions outlined to the British foundry industry. The tools of the physicist, such as X-ray apparatus—a prerequisite in the control of modern foundry practice—are expensive, but not prohibitive, but the full-time employment of a qualified man to interpret their findings is beyond the means of most of the medium-sized foundries. National activities can indicate the benefits to be derived from their application, but actual use in the foundries is a necessity and group operation by districts is the only solution. The great national research organisations give many leads for the production of better material by improved methods, and resort to the organisation of a development department is a measure for bridging the gap between discovery and practical application. These bodies would welcome the extension of grouped activities amongst the foundries as providing a quicker and more satisfactory means of disseminating information. No hard and fast rules can be enumerated as to whether purely geographical groups or those based on a similarity of output is the better, but in a small country like ours, the second has much more to commend it. The concentration of the foundry industry, however, tends at the moment to favour the formation of regional grouping, whilst on the other hand the establishment of the Export Groups ignores locality. In either case, it is not the physical creation of any such bodies which is of consequence, but the "team spirit." The idea of grouping is not new—the dictates of business acumen caused their creation in certain trades many years ago—the system being expanded until great international cartels were established. These, however, seldom exhibited the "team spirit," which infers enthusiasm both for the game and one's colleagues, coupled with a recognition of the sportsmanship to be accorded to those against which the team is pitted. In general, the "team spirit" is designed to replace the older tenets of business, which showed but little consideration for competitors. In fairness to the older conditions, it must be emphasised that in the field of science, the larger concerns were invariably philanthropic to the industries of which they formed a part by the free dissemination of the results of the researches they conducted. Even the smallest foundries benefit from this service, without being conscious of the fact. The group system would enable them to contribute their share to the world's stock of technical knowledge. Subscription to a national research organisation, whilst praiseworthy, is insufficient, as modern conditions demand technical as well as monetary support. To the objection that the small concern has neither the time nor the facilities for research, our answer is that one of the most important factors in successful production is the application of statistical methods and the wider the field from which these can be culled the more accurate and illuminating the results. Team work provides the tools for the analysis and control of production methods and the staff for the interpretation and consequently the amelioration of the final product. The benefits to be gained from group collaboration are obvious, yet before we read the cold logic, interlarded with the whimsical aphorisms of the erudite Dr. Gillett, we, in common with most, just failed to see how the very structure of progress depends upon its enthusiastic application.

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OVERCOMING A DIFFICULTY

By Proscore.

Fig. 1 shows the section of a "one-off" job that was required in a hurry; to the practical moulder this is, of course, quite a simple job to make from a pattern. No pattern was available, and the making of one was ruled out as being too costly. A strickle could have been used to "sweep up" such a casting, but in the writer's foundry other methods were adopted. In the foundry was found the rim of a pulley, Fig. 2. This was "rammed up," the joint made, and a flange (Fig. 3) placed centrally in the pulley; the "top part" was then rammed up, removed, and finished. This gave the top of the mould and carried the pad (Fig. 3). Before drawing the pattern, the segment (Fig. 4) was rammed up around the top of the pattern level with the joint; this gave the flange of the job. Again, before drawing the pattern, the strickle (Fig. 5) was used to remove the sand in the pulley to the necessary depth of 2⅛ in. The pattern was then drawn from the sand; the bottom part of the rim was filled in with sand level with the face of the mould as given by the strickle (Fig. 5). Fortunately, amongst the numerous patterns usually available in a small country jobbing foundry was found a wooden ring (Fig. 6). This was deemed to be suitable, and was placed centrally on the face of the mould given by the strickle (Fig. 5). This ring was rammed up part of the way and strickled out to the depth given by using the strickle shown in Fig. 7. The corebox was removed and the job finished, giving it a coat of plumbago, and within 3 hrs. of receiving the order the mould was ready to receive the metal. The writer does not claim this method of "overcoming a difficulty" to be original, or in any way an innovation, but it was found to be the most suitable method under the circumstances; and the resultant casting, after machining, quite justified the method described.

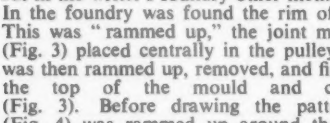

FIG.1.

FIG.5.

FIG.2.

FIG.6.

FIG.3.

FIG.4.

FIG.7.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

To the Editor of The Foundry Trade Journal.

FLUIDITY OF HIGH-DUTY IRONS

Sir,—Mr. Buchanan's interest in my recently published Paper is most gratifying, and his communication is welcomed. The high-duty irons produced as described, "inoculated" or otherwise, are very readily castable, and it is probably for that reason that the determination of relative fluidity values has not so far been contemplated. It should not be difficult, however, to conduct such tests in order to assess the practical influence of "inoculation" on the fluidity of these irons, and the findings might well inspire a short article of some interest. If Mr. Buchanan could let me have the use of his patterns, etc., the progress of the proposed investigation would be greatly expedited.—Yours, etc.,

W. W. Braidwood.
Babcock & Wilcox, Limited,
Renfrew, Scotland
July 30, 1942.

DIAGNOSING A CYLINDER COVER CASTING

(*Continued from page* 353.)

Mr. Hall raised a final point about the use of chills or denseners. He noticed that Mr. Slater had not used these or referred to them at all. What would he do if in spite of the methods he had put forward the casting did not turn out satisfactorily? Mr. Slater said he had purposely omitted to say anything about denseners, hoping that the point might be raised. In his view these aids to soundness did not cure the trouble at all. They only moved it to a different place in the casting. Eventually, he thought, the final acceptance test for any important casting would be the X-ray test, and under these conditions the employment of denseners or chills would be sufficient to condemn it. The two feeding heads, he thought, could be knocked off without much trouble, if not they would have to be sawn off.

Fireclay and Silica Refractories are now controlled as part of the Chrome Ore, Magnesite, Wolfram and Foundry Bonding Materials Control under the Ministry of Supply. Mr. H. Halliday has joined the Control as Director in charge of these materials.

MALLEABLE CASTINGS BY THE WHITEHEART PROCESS

Discussion of A. E. DAVIES' Paper by the Lancashire Branch

When Mr. A. E. Davies presented his Paper* on "The Manufacture of Malleable Castings by the Whiteheart Process" to a meeting of the Lancashire Branch of the Institute of British Foundrymen, over which Mr. W. Holland presided, an interesting discussion took place, which embraced such topics as press tools, oven design, upsetting, weathering, and simple metallurgy. The discussion was opened by MR. E. LONGDEN (Manchester), who said the bulk of the metal for the whiteheart process was formerly melted in the cupola furnace, and he assumed that such was the case at the present time. Necessarily the cupola product gave the whiteheart metal, since the difference between whiteheart and blackheart consisted in the manganese and sulphur contents. When melting in the cupola the sulphur was on the high side, and this necessitated higher annealing temperatures and longer periods of annealing, and the production of a harder variety of malleable iron than blackheart which had been termed malleable steel. Whiteheart malleable iron was far more in demand than the blackheart for certain parts of machines where stiffness was a required property in the malleable metal.

Straightening the Final Product

The analysis of the metal brought to mind the need for straightening castings after annealing. The packing and the weight of the metal of the pans created distortion, and, in his time, straightening processes were resorted to after annealing. The castings were heated up and straightened with hammers and dies. He had not experienced any great amount of hardening effect if the castings were properly dealt with after heating up again. It was really an after-treatment. This was a point which should be borne in mind.

He did not know whether the metal which Mr. Davies dealt with was different from that which had come under his own observation, but when properly dealt with whiteheart malleable iron could be worked without any undue hardening effect.

It was said that after all there should be very little free cementite about a casting if it was properly annealed, but he could not agree with the statement because in thick sections there was bound to be a certain amount of free cementite, taking the average annealing period of the oven. The annealing temperature was given as 980 deg. C. Did Mr. Davies maintain that temperature when the oven was thoroughly soaked? Was it not the rule to lower the temperature to about 900 or 920 deg. C. with beneficial effects on the casting?

With respect to the tunnel annealing of malleable iron, perhaps Mr. Davies would state what was the kind of malleable iron to which he referred. It would hardly be whiteheart, because he suggested there was a neutral gas present which prevented undue oxidation of the material, and whiteheart malleable iron depended upon oxidation to give it the properties required.

Sand for Whiteheart Practice

Any information concerning the sand used would be acceptable; for instance, was a sand used similar to that prepared for ordinary grey iron green-sand casting? He believed the practice was to use slightly more, though not an excess of, coal dust in the sand. Of course, dry sand would be used for the larger castings. The point was, apparently, that since the castings were brittle more coal dust was introduced, because it caused the sand to drop away from the casting more easily, thereby avoiding the trouble of brushing and a certain amount of handling.

Dealing with the proportion of new ore to old ore, in the case of a foundry making a general run of castings, it would be difficult to segregate sufficient castings to apportion the ore in an oven. Did Mr. Davies suggest that an ovenful of ore would contain in the pans varying proportions of ore? Did he mean that in the case of a heavy boss section he needed practically all new ore in order to create the maximum amount of oxidation in a part which would require it?

Ore Mixtures

MR. DAVIES, dealing with the proportion of new ore and old ore used for annealing purposes, remarked that the general principle was to vary the ratio of new ore used for each particular casting, taking into consideration maximum and minimum section thicknesses. In such a case provision would be made for an ore mixture to deal with the thicker part of the casting, and the thinner part of the casting would be more or less ignored. Castings were packed in pans, the size of the pans varying according to the size of the castings. In

* See "Foundry Trade Journal" for March 12, 1942.

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general practice small pans were about 13 in. dia., and probably 14 in. high. They were packed in tiers in the pans, sometimes about six high, according to the height of the furnace. It was the practice to vary the iron ore according to the thickness of the section of the casting. When annealing castings approximately 4 in. long, having a section of only ½ in., probably an ore mixture of three parts of old ore to one part of new would be used.

Melting Furnace Changes

Turning to the question of melting furnaces, Mr. Longden had mentioned the cupola as being the most popular melting medium. This used to be the case some years ago, but to-day, in the malleable-iron foundry, the cupola was definitely losing ground, chiefly on account of the use of hematite and steel mixtures. When using a cupola, the fact would be appreciated that by using a hematite pig-iron the material would contain up to about 1.4 per cent. of silicon. A mixture with steel scrap would bring about the desired analysis. Steel scrap contained but little silicon. It was a case of mixing a material with minimum silicon with another material containing about 1.4 per cent. silicon. Again, the melting point of steel as compared with hematite iron was very different. Hematite pig would melt at a temperature of somewhere about 1,150 deg. C., while for steel a temperature of 1,350 or even 1,400 deg. C. was necessary.

The cupola was certainly not popular for melting two irons having such a disparity in silicon, because the silicon percentage was most important and must be uniform. This consideration had favoured the rotary furnace, though it probably did not cost very much more, in order to get the iron at the required melting temperature.

Another matter which tended towards the disuse of the cupola was the steel scrap which had to be used in cupola practice. Punchings were very popular and very cheap, but they were not suitable for cupola melting, because they trickled down into the well of the furnace, with the result that there was a hopeless mess. The general principle was to use steel which was large enough not to trickle through the coke, and which would remain in the charge until it got into the melting zone.

Another feature which militated against the adoption of cupola practice was the carbon pick-up. The usual practice was to keep the carbon content as low as possible during melting, though there must be a certain amount of carbon in the charge in order to induce fluidity in the iron.

Press Tools

A question had been raised concerning machine tools. Perhaps he had somewhat misled his hearers with regard to that subject. He did not mean that malleable-iron castings, hardened and tempered, would approach anything like the quality of high-speed tool steels. In the case of presses and the like, malleable-iron castings were definitely of great assistance if a tool or die was wanted quickly. When it was desired to start with a piece of cast steel or high-speed steel it was machined out of the solid, whereas with a malleable-iron casting the casting could be made practically to the required shape during the moulding operation. Very little had to be taken from the casting in order to clear the ferrite area, which was really the outside and contained absolutely no carbon. Generally speaking, the casting itself would yield carbon content of between 0.4 to 0.8 per cent.

It was an advantage when making press tools to arrange the annealing so that the carbon was not completely removed, the percentage of carbon present being round about 0.7 to 0.8 per cent. This was almost the eutectic composition. Practically the whole of the structure of the iron intended to be used for press tools would be pearlite. By adjusting the annealing process sufficient carbon could be retained in the malleable-iron casting to harden and temper it.

He had frequently used press tools made of malleable-iron castings. The fact that with hardened malleable-iron castings, a tensile strength could be obtained in excess of 60 tons to the sq. in. proved that there was quite an appreciable amount of carbon left in the casting.

The Upsetting Process

Malleable-iron castings were certainly straightened, very much to the annoyance of the foundry manager, but if they were heated to 850 deg. C. they were not hardened at all. The general practice was to heat the castings to about 750 deg. C. The castings could then be straightened in the press, or hammers could be used; very little difficulty would be experienced in straightening the castings.

Malleable-iron castings could be heated up to 700 deg. C. and quenched with water and still retain quite an appreciable amount of their malleability. They were not hard, but the carbon in the casting was immediately hardened at a temperature of 850 deg. C.

If castings were properly annealed there should be no cementite in the structure at all; the cementite was broken up. With cementite there was pure iron carbide of the formula Fe_3C.

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If during annealing the temperature was maintained at about 980 deg. C. for 36 to 40 hours, and then reduced to about 850 to 900 deg. C. the quality of the malleable iron would be definitely improved. Any tendency to get castings in and out of the oven as quickly as possible should be restrained though the practice did not deteriorate the castings to any very great extent. Castings which were annealed at the maximum temperature of 980 deg. C. throughout the whole of the process would certainly comply with the B.S.I. requirements for mechanical test.

Coal Gas in Tunnel Ovens

When using the tunnel oven for blackheart malleable iron castings, a blackheart mixture was not actually used, but rather a composition intermediate between that and whiteheart. With regard to the process gas used, the tunnel was supplied with ordinary coal gas in definite proportions in order to provide an atmosphere which contained sufficient CO_2 to react with the iron carbide in the casting. Where the castings were packed in pans the CO gas burned at the top of the pans. Of course, this could not be seen in the case of the tunnel oven. The process gas was produced to give a gas which would not be excessively oxidising in its action but which would remove the iron carbide from the malleable-iron casting. Fortunately, iron carbide was very easily removed; much more easily than was the case with free graphite which was very difficult to remove in the case of a hard casting, and, in fact, if it was removed the tendency was to create cavities.

Sand Mixtures

Sand mixing was very much the same for malleable iron castings as for grey-iron castings, although the metal for malleable-iron castings was not quite as fluid in character. The permeability of the sand must definitely be very high; if it was not, then there would be very great difficulty experienced if the castings were extremely thin.

Coal dust was a very useful substance in malleable-iron foundry work, but for very thin sections its use was dispensed with as much as possible, reliance being placed mainly upon the coal dust in the heap sand.

High Sulphur and Casting Temperature

MR. TURNER (Hollinwood) said that there appeared to be a high sulphur content used in a mixture of hematite and steel. Was the sulphur purposely introduced? Also, was phosphorus detrimental to malleable irons? When advocating that the casting temperature should be as low as possible, was not this likely to induce blowholes and slag inclusions? Again, did process gas replace the ore, or was it in addition to the ore?

MR. DAVIES remarked that the quality of malleable castings was definitely improved the quicker the castings were cooled through the various stages to be associated with the iron-carbon diagram. Temperature did much to heat up the sand, and cooling took place more quickly if a temperature was used which was just sufficient to cast the casting properly.

There was never much phosphorus present in hematite iron, but occasionally batches arrived carrying more than usual. The practice was to use a hematite iron with as little phosphorus content as possible. The B.S.I. specification set the maximum at about 0.3 per cent. Such a percentage did not cause any trouble in the foundry. High phosphorus would cause a great deal of trouble, and make castings very brittle; in fact, more so than would sulphur. A sulphur content of 0.8 per cent. would certainly be excessive; it would be ridiculously extravagant. In one case sulphur was introduced experimentally by melting iron sulphide with the charge in a pot furnace. The quality of the iron obtained with a silicon content of 0.8 per cent. was surprising, and went to prove that high sulphur and high silicon contents were of considerable help in regard to the fluidity of the iron. The higher the silicon content the more fluid the iron. But since it was necessary to preserve the carbon in the combined state, and there was a greater tendency for the carbon to exist as graphites, adjustments must be made to prevent this, and so sulphur was used. Generally speaking, the sulphur pick-up in the cupola was very great.

MR. TURNER said he meant from the point of view of the rotary furnace.

MR. DAVIES said that, from the rotary furnace point of view, the sulphur content was definitely much lower. Hematite irons might have a silicon content as low as 0.4 per cent., whilst other qualities would be definitely grey. There were charcoal irons which could be bought with a silicon content of 0.5 per cent.

MR. HAROLD HAYNES (Ashton-under-Lyne), referring to mixings for the cupola and for the rotary furnace, asked whether Mr. Davies added silicon when the metal was tapped out of the rotary furnace, because he (the speaker) thought silicon losses were appreciable in this furnace.

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Points upon which he asked for additional information were contraction; camber; and the rusting of castings. Some foundries allowed the hard castings to remain in the rain for rusting purposes. Judging from personal experience, every casting should be so treated, as it favoured machine-shop practice.

Modern Rotary Furnace Practice

MR. DAVIES said that, generally speaking, the silicon content was reduced during milling in the rotary furnace, but many people manufacturing malleable-iron castings by this process introduced the subsequent charge into the previous charge, that is, they would melt the whole of the cast, but would use only half of it. Thus, when the furnace was half empty, a new charge of hematite iron and steel scrap would be introduced. This became immediately covered by molten iron which prevented the oxidation of silicon to a very large extent. Quite a number of people using the rotary furnace were doing so in order to obtain a more frequent supply of liquid metal.

Camber was never put on a pattern for malleable-iron castings intentionally, unless it was of a very heavy character. Even these did not warp very much, and the camber was very rarely used, chiefly owing to the fact that malleable-iron castings were not made in such large sizes as grey-iron castings. A malleable-iron casting of 5 cwts. was a particularly heavy one from the malleable aspect.

Weathering Malleable Castings

He quite agreed that castings were improved by being put out to weather. He thought this was due to a large extent by the rust getting underneath any sand which was left on the castings, so that the sand came away very easily. Much trouble could be caused owing to sand becoming fused on a casting. If a casting to be machined was perfectly clean and free from sand, very little trouble was experienced with the machine tools; but immediately a high-speed tool touched a bit of sand, its edge was gone. As a matter of fact, it was much easier to machine castings which were somewhat on the hard side rather than castings which contained sand on the surface. Hard spots on castings could prove to be very inconvenient from the machinist's point of view, and though he might be wrong, yet his opinion was that they were caused through splashes of metal created during casting. Hardness from spots in casting could be greatly reduced if the metal was not allowed to splash at all when it was going into the mould.

Panless Annealing

MR. E. LONGDEN (Manchester) said that reference had been made to the tunnel oven not needing pans. Had Mr. Davies experience of work with an oven in which cast-iron pans were not used, either rectangular or round ones? Take the case of an oven constructed with a central chamber, and about 15 ft. in length, 10 ft. in depth, and with two fenders running the whole length of the oven, rising to within about 18 in. of the surface at the top of the oven, and the width of the chamber being something like 2 ft. The castings would be packed practically between the two big fenders, the whole being something like 5 tons weight in the ordinary way. The gases were caused to descend through the centre of the packed castings, through tubes, and also through tubes right at the end of the oven proper. Of course, the usual brick fender was built up round the doors. While it took longer to heat up the oven to the required temperature, namely, something like 40 hours, the castings were thoroughly annealed, allowing for the extra soaking period. From the point of view of economy, it would be found well worth while to use such a type of oven with ordinary pans. The pans did not last very long, perhaps for five or six heats, and, considering the economics of the job, he would have continued to use such ovens had he remained in the trade much longer.

MR. DAVIES said that many years ago he conducted experiments on the lines indicated by Mr. Longden, but without achieving satisfactory commercial results. It seemed to him that the method was very similar to the one adopted in the new process of cycle-annealing, apart from the fact that a definite process-gas was used to prevent oxidation. He could quite imagine malleable castings could be obtained from an oven of that type, but there would probably be excessive oxidation of the skin of the casting. He had also used an experimental laboratory muffle furnace. First of all, he passed the gas through the furnace before he passed it to the burners. It was a very wasteful method. He was speaking of about 20 years ago when short cycle-annealing commenced. Some amount of malleability was created by passing the gas over the casting before it went to the burners of the furnace. The burners were at the bottom of the heating chamber.

Mr. Davies then drew a diagrammatic sketch on the blackboard indicating the type of furnace used.

The gas was passed from the main through the chamber containing the particular casting. It then came out from the back of the furnace, and

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went in to the burners. By this method the castings were certainly annealed, but it was a very expensive operation. Generally speaking, the older method, coupled with the economy in pans, was not very expensive. A pan usually lasted for six heats when using an optimum temperature of 980 deg. C. Five lives were considered to be fairly good, and six lives somewhat exceptional. As a matter of fact the pans, at the end of the sixth time in the oven, were no thicker than paper. It was not economical to use them when they were so thin, because very often the pans would be holed, with the result that castings would be spoiled.

Fuel Requirements

MR. LONGDEN inquired whether coal was used as the heating medium for annealing? Was it a hard fuel or pulverised coal?

MR. DAVIES replied that the type of furnace he definitely favoured was the old-fashioned type using hard coal. The success of the furnace depended upon this, otherwise the required temperature could not be effectively obtained. Since hard coal was not mined in Lancashire, resort was had to the West Cannock Collieries. The furnace was built up in the shape of an arch, and had a solid bottom. The flues came out from two places in the bottom of the furnace, at the back of the wall, and connected with the main flue. In the particular furnace to which he referred, there were three rows of annealing pans when looked at from the front; but actually there was a depth of probably eight or ten pans. The capacity of the particular furnace he used was 115 pans, and the hard coal was simply thrown in through a door to the side. There was no retaining wall for the coal, which simply went right alongside the pans. Very little trouble arose from what was a common fault in annealing—that of having the castings not annealed in the bottom part of the oven. It was very questionable whether there was 0.5 per cent. of castings not sufficiently annealed.

His firm dealt with castings which were definitely grey iron. He had had considerable experience with furnaces which were on the market, and he thought that with coal-fired producer type furnaces it was certainly economical from the fuel standpoint; there was difficulty experienced from the bottom pans not receiving sufficient temperature, so that the resulting castings were unannealed.

Consideration had recently been devoted to the use of pulverised coal to fire furnaces. About 30 h.p. would be necessary to pulverise the quantity of coal required, and having regard to this figure there would not be any economy effected by a changeover to the use of pulverised coal. Personally, he favoured the use of Staffordshire hard coal for annealing malleable-iron castings.

Alternative Fuels

MR. LONGDEN said his experience had been similar. He had not actually used pulverised coal, but he had used producer gas. There was not a uniform temperature obtained throughout the whole of the furnace as was the case with a straight hard-coal fired furnace. He was surprised to learn that coal was charged directly parallel with the door of the oven. The ovens he had in mind had just a short fender which would allow the gases to circulate and penetrate down to the bottom, being pulled down by the flues, and not impinging directly on the pans; which there would be a tendency to be if the coal was fired directly on the floor of the oven.

MR. DAVIES said that in the case of the particular process of annealing he was describing, for instance, an oven which was packed, if work had begun on Thursday morning, say, the castings would be coming out of the oven on the following Monday. A certain amount of economy in pans was sacrificed because the castings were wanted very quickly. The method certainly made much better working temperatures possible. The incandescent fuel, being in contact with the cast-iron pans, certainly caused the bottom pans to wear a little. The wear could not be regarded as excessive.

Temperature Control

MR. E. L. HOWARD asked whether there was any pyrometrical control of the annealing oven? If so, where was the pyrometer placed? If the oven was packed on Thursday morning, and the castings were withdrawn on the following Monday, that was a five days' annealing. Was the temperature taken up to 980 deg. C., held there for a short period of eight or 12 hours, and then brought down to about 850 deg. C., and held there, and then brought down slowly, then held, and taken up again, and then brought down? He understood that was the American practice.

After stripping the castings from the mould, were any precautions taken to relieve stresses, such as a short heat-treatment of a few hours, prior to packing for annealing?

After welding or brazing was it necessary to heat-treat malleable-iron parts, as he had known of cases where fractures occurred? This trouble had been overcome by a short normalising.

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MR. DAVIES remarked that pyrometrical control was essential for the manufacture of malleable-iron castings, but pyrometrical control of furnaces could be very misleading, because if the end of the pyrometer was put into the furnace, then there was a tendency not to record the temperature of the furnace, but to record the heat of the flame.

Dealing with the five days' annealing, the castings were packed on the Thursday and the furnace lighted up during the Thursday evening, usually about 5 o'clock. It was expected that the furnace would be up to 980 deg. C. at least, and often it was in excess of that temperature. Allowing for temperature lag, 1,050 deg. C. were obtained in the first 24 hours. At 5 o'clock on the Friday evening it was claimed that the temperature of the castings was 980 deg. C., allowing for temperature lag. This temperature was maintained for 48 hours. On Sunday night the furnace was knocked down. The front of the wall of the furnace was pulled down and the castings were allowed to cool normally. Unless a casting was required for high duty, then the ordinary process of annealing at 980 deg. C. was sufficient.

Normalising

Normalising had been mentioned in the Paper. It was necessary to normalise certain types of casting in order to prevent cracking during annealing. The castings were taken from the sand as quickly as possible, and transferred into a normalising furnace at a temperature of about 850 deg. C. They were then normalised for 8 hrs., and allowed to cool down in the furnace. When the castings were taken from the furnace, they should be cool enough to handle quite easily. Particular strains and stresses were brought about by uneven cooling and alteration to structure of the iron, thus causing the cementite areas to be broken up with a slightly more abundant pearlite. Actually the difference was very small and could only be detected under the microscope; but it certainly did take place. If a malleable-iron casting, which was very thin, was held up and made to "ring," the reverberations were so numerous that they would continue for a matter of 10 min. or so before they ceased. When an ordinary casting had been normalised, it gave an ordinary "bell" tone which quickly died away; and this was one of the indications that the normalising had been done sufficiently. By "ringing" it was possible to foretell whether there was a tendency for the casting to break during a subsequent operation, and whether it was necessary for it to be normalised.

In the Lancashire district there were castings which were put on the ends of the beams in the looms. Some difficulty was originally experienced with regard to this particular type of casting. The man at the oven often used to listen for the castings to crack when they were being annealed. Perhaps 90 out of 100 were cracked. This difficulty was overcome by alterations of metal mixtures and by proper normalising.

Blackheart v. Whiteheart

MR. T. MAKEMSON wished to congratulate Mr. Davies upon having prepared a very concise review of the art of manufacturing whiteheart malleable castings.

In any discussion respecting malleable castings it was inevitable that there should be a comparison made between whiteheart and blackheart, although this was not quite fair to Mr. Davies, who had rigorously confined the subject matter of his Paper to whiteheart. On the whole, the concensus of opinion appeared to be that better results were obtained from blackheart castings. The B.S.I. tests for blackheart castings were more rigorous than those imposed for whiteheart castings, but whereas the very best blackheart castings might be better than the best whiteheart castings it was very easy for inexperienced people to go wrong with the former.

There were many elaborately designed annealing furnaces at the present time, but some of them were not necessarily better than the comparatively simple type which even Mr. Davies preferred to use. Quite a large number of malleable castings were being successfully annealed nowadays in ordinary brick kilns.

When a casting was made in a grey iron foundry it was made, and usually no further trouble was experienced with regard to it until it arrived in the machine shop. In the case of a malleable casting the foundryman had to contend with the additional process of annealing, and straightening became an important matter.

He knew of a large malleable iron foundry which made motor vehicle castings where every casting made in the foundry was put into a press and pressed to the required shape in dies. This was a practice which, although it involved considerable capital expenditure, produced accurate results.

He surmised that one of the reasons why whiteheart castings were popular was that they could be made quite successfully from the cupola, although, as Mr. Davies had pointed out, some other kind of furnace was better if the foundryman was prepared to instal it. Cupola blackheart

castings were not an easy proposition. There were many cupola blackheart castings being made, but the work had to be done by people who had had considerable experience in their manufacture. It was preferable to have some other kind of furnace; either an air furnace, an electric furnace or an oil furnace, while in one case, in this country, an open-hearth furnace was used.

The motor vehicle industry had opened a field of activity for malleable. It would be advisable for anyone who was considering taking up the manufacture of malleable iron to do so upon a strictly scientific basis from the very beginning. This was what Mr. Davies had done, and it was the way in which most firms successfully manufacturing malleable iron had commenced.

Mr. Davies said blackheart malleable castings were definitely superior to whiteheart castings, but they required much more careful handling and sand control; particularly from the sulphur, silicon and carbon points of view.

Scrap Absorption

MR. HOPWOOD (Liverpool) asked whether there was any difficulty in utilising, say, heavy fettling shop returns in all their varieties? He presumed that they were fairly heavy in the case of malleable cast iron. What was their proportion; also, what was the proportion of new metal, if one liked to call it so, of hematite pig, or hematite scrap which was used?

MR. DAVIES replied that annealed returns did not cause any great trouble to the general organisation of a malleable-iron foundry. Years ago it was considered to be bad practice to put annealed malleable-iron castings into the charge; but to-day it was frequently done. With scientific control, there was no reason at all why it should not be so. For instance, if a charge of nothing else but malleable-iron castings was put into the furnace, there would be a finishing up with a hard iron perfectly white which was very similar to the ordinary material used with refined hematite. The sulphur would probably be higher, the carbon would not be so high, while the silicon would certainly be lower. With scientific control, balancing other ingredients put into the cupola along with the annealed scrap, there was not much difficulty experienced; but it was important to control the sulphur and manganese in the ordinary way. There should always be about twice the amount of manganese in the charge as sulphur. Otherwise, there did not appear to be any reason why the annealed malleable scrap from the fettling shop should not be introduced into the furnace.

The best castings were certainly made with virgin iron, as representing a uniform charge. If it was desired to make really good malleable-iron castings, the best course was to use nothing but refined hematite. Of course, economically speaking, this could not be done. There had to be a mixing with the ordinary foundry scrap and also with the returned annealed scrap. Returned annealed scrap was often disposed of by making it into pans, though he himself used a mixture of hematite and steel.

MR. HOPWOOD understood that Mr. Davies had charge also of a grey-iron foundry which, under present conditions, was an advantage some foundrymen did not enjoy. If phosphoric irons which were not wanted in a malleable-iron foundry were utilised in a grey-iron foundry, the result would be reasonably strong castings in the grey-iron foundry.

Cheap High-Duty Irons

MR. DAVIES said that if a high-duty grey-iron casting was required, the proportions were mixed in, and often a pot was sent to the malleable foundry to be filled in with two-thirds of malleable iron. In the result, a product was obtained with a very good tensile strength and which machined fairly easily.

MR. B. B. KENT (Altrincham) asked whether for normalising a malleable casting could be heated up to 850 deg. C. without hardening.

MR. DAVIES said there would be no hardening owing to the fact that the castings were slowly cooled after the normalising process. Actually, there was no reason at all why they should not be heated to 980 deg. C., provided it was followed by slow cooling. If the casting was heated to 850 deg. C., and then quenched with water, the result was that the malleable-iron casting became almost like cast steel. That hardness could be reduced by tempering.

Fracture Considerations

MR. HOPWOOD said he always thought that whiteheart malleable was essentially a decarburised product. From what he had heard during the reading of the Paper, and in the course of the discussion, it appeared to be a mixture of the two. Apparently, there was only the skin which was completely decarburised, while the rest of the carbon was brought out of solution in a spheroidised form of graphite. Could Mr. Davies explain why its deposition in that form in the whiteheart process did not colour the fracture in the same way as occurred with blackheart?

Whiteheart Malleable Castings

MR. DAVIES said the whiteheart process of manufacture incorporated a decarburising effect. There was probably about 0.3 or 0.4 per cent. of graphitic carbon in an unannealed casting, and after completely malleablising, the percentage would go from 0.3 to 0.8 per cent., or there might even be 1 per cent. of total carbon, made up of little nodules of temper carbon, which certainly in some cases did darken the fracture of a whiteheart casting. With the more popular method to-day, with higher silicon, there was a mixture between the blackheart and the malleable, although it was definitely a decarburising process for the manufacture of whiteheart castings. With the blackheart casting, theoretically there was no decarburisation at all. It was simply a matter of breaking up the carbon and splitting the carbon nodules into tiny nodules of temper carbon. The packing for blackheart castings was usually sand or cast-iron swarf. No oxygen was introduced into the furnace. It was a rearrangement of carbon rather than a removal of carbon. In fact, after prolonged annealing, the spent ore coming from the furnace responded to the magnet. It could actually be taken out by means of a magnet. Actually, the iron was reduced from the ore during the whiteheart process, but with the blackheart process there was no reduction at all; there was merely a conversion of the carbon into another form.

SHEFFIELD BRANCH ACTIVITIES

(*Continued from page* 356.)

required, type of pattern and metal required, that he was sure a lively discussion would follow.

Discussion

MR. F. E. STEELE showed several ways the pattern would be made for cast iron. If only one casting was required it would be a three-part job with the circular flange loose, and cast with this flange at the bottom. Alternately it would be a two-part job moulded in a similar manner, but with the circular flange covered with a core in ramming up the bottom part, core removed to take out the loose flange, core replaced and bottom part finished rammed up. Another method for mass production in iron would be to mould with the groove vertical and the pattern split on the diameter of the circular member and flange. It would be easier if the 3-in. dia. bosses behind the groove were made "D" shaped to avoid the extraction of loose pieces in moulding.

MR. G. OFFILER made a number of sketches on the blackboard to show how the pattern would be made for different methods of moulding. In his experience in making patterns for the trade he had had to become accustomed to the production methods of many foundries, and he would always advise the patternmaker to spend ten minutes in the foundry to talk over each job before he started to make his pattern.

MR. T. TURVEY had looked over the blueprint and models from two angles: (*a*) Assuming that a rough joiner's model had been supplied for one-off, and (*b*) for large production requirements in steel. Frequently patterns arrived which were only models, and the foundryman had to make the cores in the mould as he went along, and use much ingenuity in making the mould and cores. For larger quantities he would mould so as to be able to use a whirlgate head with two ingates feeding into the casting, at the circular flange and the slide. A spirited discussion followed with contributions from Mr. Meredith Mr. Brittain, Mr. Webb and Mr. Shepherd, and the various points of difference between the designer, patternmaker and moulder created so much interest that it was suggested that representative castings should be made and sectioned by individual foundries, with photographs and sketches of the different methods to form the basis for a further discussion later.

INDEXES FOR VOLUMES LXVI AND LXVII

To keep the volumes of the "Foundry Trade Journal" of reasonable size in the new format adopted with the issue of April 23 last, it has been decided to close Volume LXVII, which commenced on that date, at the end of the current month and to start a new volume with the first issue in September. The next volume, LXVIII, will run to the end of the year, making three volumes of roughly four months each for 1942.

The Index for Volume LXVI, January 1 to April 16, 1942, is now ready. The Index for the current volume, LXVII, will be ready on September 7 next. Applications for both indexes should be made immediately to the Publishers of the "Foundry Trade Journal," 3, Amersham Road, High Wycombe, Bucks.

Opacifiers and Fused Viscosity of Felspathic Glazes.—At the recent convention of the American Ceramic Society, James R. Beam described a study of the fusion characteristics of felspar, flint, clay, kaolin and whiting in glaze compositions in combination with zinc and various opacifiers. The fusion characteristics of tin oxide, Opax, Zircopax, and various combinations of opacifiers were given. All heat-treatments referred to were at cone 12. Iso-viscosity tri-axial diagrams showed the fields of good glazes in each series, and the relative effects of composition changes on the physical properties were outlined.

DIAGNOSING A CYLINDER COVER CASTING

II.—MACHINE MOULDING

by L. E. SLATER

At recent meetings of the East Anglian Section of the London Branch the production of a specimen casting was discussed from various angles

It is proposed to outline briefly how the foundry planning and pattern equipment department of the author's foundry would have been instructed to construct the pattern equipment, together with methods he would use, had he been given this job to produce by *machine moulding*, whilst using a high-duty iron, conforming to the Grade 2

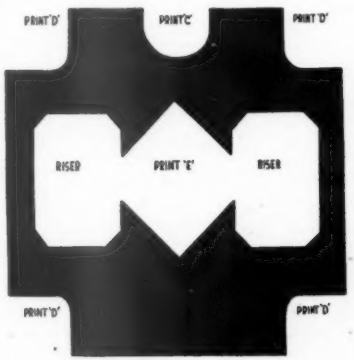

FIG. 1.

FIG. 2.

B.S.S. 786, 1938, revised 1941. To conform with this the following mixture is suggested:—33.3 per cent. steel; 29.1 per cent. remelt and 37.5 per cent. pig-iron containing T.C, 3.7; Si, 2.9 to 3.0; Mn, 1.0; S, 0.03, and P, 3.0 per cent. max. Seven pounds of C Si per ton would be added as an inoculant. This mixture would yield the following composition:—T.C, 3.0 to 3.1; Si, 2.0 to 2.2; Mn, 0.6; Si, 0.085 max.; P, 0.25 to 3.0, and Cu, 1.15 per cent.

The job is fairly straightforward, being actually one casting (in the shape of suction and delivery pipes) within another (this being the water jacket). The requirements are that the casting shall not leak under a hydraulic test of 2,000 lbs. per sq. in. applied to the suction and delivery valve pockets separately, the water jacket being tested at 50 lbs. per sq. in.

The metal sections vary considerably, and porosity troubles can certainly be expected in the

FIG. 3.

FIG. 4.

thickened sections, particularly at the apex where the suction and delivery ports meet, the thin outer section will naturally be the first to set, and therefore obstructs any ready means of feeding the thickest section. The position which seems to offer the best solution to the feeding problem is to bring the machined surface to the top, this also makes it possible to get feeders over the thickest section of all.

As the pattern is to be machine-moulded, there must be no loose pieces. The pattern would be split through the $2\frac{3}{8}$ in. centre of the double facing, and printed up to the centres of both oval

Diagnosing a Cylinder Cover Casting

facings; the core line on one would be at an angle and carried below the joint line, to strengthen the thickness of sand in the core. As there is no connection between the two main cores, a print covering the top surface would be added. The reason for this addition will be apparent when the core assembly stage is reached. Four core prints should be added one on each of the long bosses.

Coremaking Problems

As the coring offers separate interesting problems, it is proposed to deal with this feature in two parts: (*a*) assembly of the internal coring, and (*b*) coring up the mould.

Assembly.—The reason for the existence of the facing core is apparent from a study of Fig. 1. The core forming the suction and delivery ports, etc., is shown in Fig. 2. This core could be made in halves and jointed, or by other means. It should be noted that this core has a square location E, corresponding to the one in the centre of core No. 1. The cores shown in Figs. 3 and 4 forming the water jacket are slid into the locations, one at each corner of No. 1 core. The reason for this is that it is impossible to pass the jacket core (either in halves or whole) over the suction and delivery pockets core any other way.

The four small cores, Nos. 5, 6, 7 and 8, are assembled into their respective positions, which are indicated in Fig. 5. Therefore, the whole internal coring is now one unit.

The only corebox that needs special mention from the construction point of view is the one forming the jacket core.

Core to the centre of the oval facing, the core having been made to carry through the outer wall thickness.

The assembled main core is so made that it can be fastened in a jig and lowered into the mould using the pin centres for location. This is perhaps the most accurate method of core location. The depth of the jig should be the same as that of the pattern on the top plate.

Runners and Risers

The runner would be placed so as to provide a small ingate into the two thin outer sections. The downgate would be 10 per cent. larger than the channel; the latter would be 10 per cent. or more larger than the total cross-sectional area of the ingates. The runner system to be fastened on to the top plate and treated as part of the pattern equipment. Fairly slow running would be sought, using a metal having a temperature in the region of 1,300 deg. C.

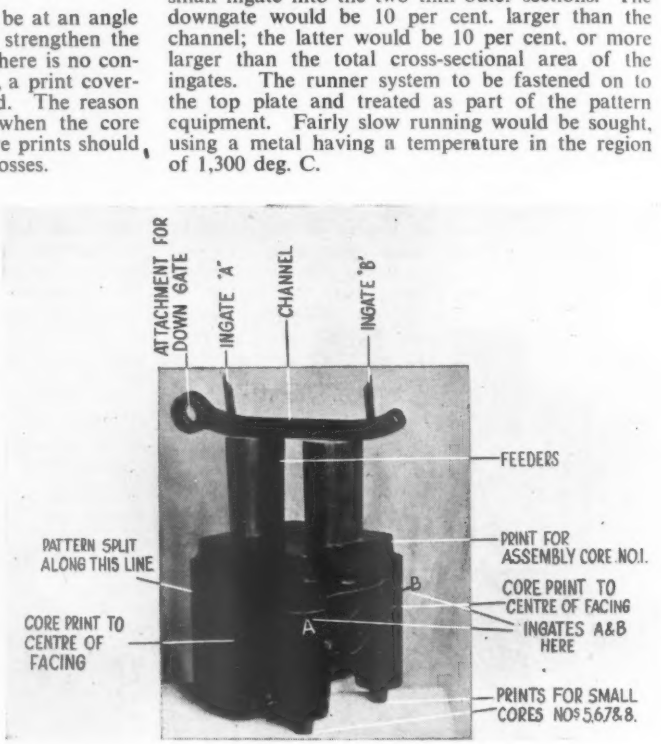

FIG. 5.—SHOWING PATTERN ARRANGED FOR MACHINE MOULDING, WITH CORE PRINTS, FEEDER HEADS AND GATING SYSTEM

Two feeders would be used, as near to the centre of the casting as possible. The height of the feeders would be treated as important, and no height less than 5 in. from the top of the casting would be tolerated.

Sand Specifications

A suggested specification for the moulding sand is that it should be of the synthetic type, carrying a permeability of 40, a strength of 6.5, and a moisture content of 5.0 per cent. For the core sand it is suggested that this should be an oil sand carrying 3 per cent. oil and yielding a permeability number of 150.

Diagnosing a Cylinder Cover Casting

DISCUSSION

The CHAIRMAN (Mr. George Hall) asked Mr. Slater's reasons for running the casting slowly, as he thought that, when using an iron of the high-duty class with a shorter freezing range, it would have been an advantage to pour quickly. Also, why was a jig used for setting the cores?

MR. D. CARRICK raised a point about how the vents were taken off, and inquired how the halves of the core were jointed. He wondered how Mr. Slater would remove the two large risers from the casting, and thought it possible that they might leave a mark on the face of the cover where the spigot was machined for jointing to the cylinder. Also, in producing the casting with the jointing face uppermost, he thought it likely that dirt might be located at the spigot.

MR. J. L. FRANCIS said he was impressed by the thorough and efficient manner in which Mr. Slater had dealt with the problems involved. He agreed with him about the pouring speed and considered that at the temperature mentioned, namely, 1,300 deg. C., no difficulty would be met. Further, he understood from Mr. Slater's remarks that the casting would be made in a green-sand mould.

MR. H. H. SHEPHERD (Past-President) remarked that the exacting requirements and the important nature of the casting warranted casting it in a dried mould constructed entirely of cores. He agreed with Mr. Slater's choice of runner because sounder castings often resulted from decreasing its size providing pouring was not done so slowly as to cause scabbing. He thought that metal temperatures taken with optical pyrometers were often misleading, and large discrepancies between measurements so made were possible unless highly standardised conditions were maintained. The height of the runner too was an important feature, and so was venting. Even with open sands, venting was a definite advantage, since the easier the gases could escape the better it was. Finally he too commended Mr. Slater on the able way in which he had dealt with the problems.

MR. C. H. KAIN said he was disappointed that so little had been said about the actual construction of the pattern and coreboxes, particularly with respect to replacement of the parts where wearing occurred. Regarding colours of patterns, standard colours had been laid down by the Institute, and were now incorporated in a British Standard Specification. It was difficult to understand why they were not more widely adopted. If the top part of the mould was closed over the core prints there would be danger of crushing. On the other hand, if the prints were made loose enough to avoid this, metal might run into the vents. Mr. Kain also asked why Mr. Slater had fixed on 5 in. minimum as the height of the feeder heads; had he any rules governing this? A similar query could be raised with respect to the pouring time adopted. He agreed that it was wrong to stop pouring when the risers were half full and to add hot metal to the top of the feeder heads. This caused porosity under the feeder. The Iron and Steel Institute had condemned the use of optical pyrometers, and recommended immersion couples of the noble metal type. To conclude his remarks, he congratulated Mr. Slater on the excellent talk he had given.

MR. O. SMITH said that although the author was not in favour of sand to sand location of cores from the accuracy standpoint, he had resorted to it in the assembly of the halves of the centre core. He agreed wholeheartedly that setting of cores by jigs was well worth the extra expense in that it saved castings from being scrapped.

Author's Reply

MR. SLATER, replying to the questions raised, said the reason for the slow running by two small ingates into the thin jacket was in order to try to equalise the cooling rate so that this part should not set first and draw metal away from the thick sections. So far he had not yet been able to evolve any formula for correct feeder head height, but experiments were under way Meanwhile he used a rule of thumb method, namely, double the depth from the joint. Standard pouring times were related to the area of mould surface, and he gave the following relationships:—

$$\frac{\textit{Area of downgate}}{1.4} = \text{C.S.A. of channel.}$$

$$\frac{\textit{C.S.A. of channel}}{1.2} = \text{Total C.S.A. of ingate.}$$

The total cross-sectional area of the ingate could be made up from a number of different sizes of section. With respect to jointing of cores, Mr. Slater said that a satisfactory jointing medium could be made up from the usual jointing compounds mixed with silica flour. The difficulty of registering the top part over the core points could be avoided by assembling the cores in the top part by the aid of a jig. Regarding Mr. Kain's comments about dealing at greater length with the construction of the pattern and coreboxes, he had considered this point, but decided that in order to leave adequate time for discussion it would have to be omitted.

(*Continued on page* 342.)

ECONOMY IN NON-FERROUS METALS IN CAST COPPER ALLOYS

This statement of the economy in the use of tin and other non-ferrous metals in cast copper alloys has been prepared by the Non-Ferrous Metals Control and is issued by the British Standards Institution on behalf of and at the request of the Control.

The enormously increased demand for non-ferrous metals for war purposes and the restriction of supplies available make it necessary for the most stringent economies to be effected in their use. It is no longer possible to maintain peacetime standards of perfection and it is the duty of all to ensure that the quality of the material employed is never higher than is absolutely necessary. The need for economy applies to all non-ferrous metals including those most commonly used in cast copper alloys, such as tin. Approximately one-third of all the tin used in this country goes into copper alloys. It is essential, therefore, that tin bearing alloys should never be used if a tin free material can be employed, and that, where this is not possible, the tin content should be reduced to a minimum.

To assist users to meet this urgent need, a new range of standards for copper alloy ingots and castings, Nos. 1021-8: 1942, has been prepared and issued by the British Standards Institution at the request of the Non-Ferrous Metals Control. Attention is drawn to these standards which immediately supersede certain existing standards. The foreword to Standards 1021-8 explains their purpose and makes recommendations for their employment. The purpose of this document is to emphasise the importance of an immediate change-over to alternative alloys.

The following general considerations should be borne in mind: (*a*) Never use a non-ferrous metal or alloy unless it is certain that there is no substitute available which is in more plentiful supply; (*b*) where a non-ferrous material is necessary use the least possible weight of the lowest possible grade; (*c*) make sure that all scrap is kept clean and free from contamination. Use the highest possible proportion of scrap, but never of a higher grade than is absolutely necessary; (*d*) do not hoard your scrap. If you cannot use it for approved purposes, sell it and put it back into circulation; and (*e*) if you are accumulating in your works residues such as skimmings, casters' ashes, sweepings, etc., and cannot re-use them in your own products, the Control will advise you where this material can most usefully be directed.

With particular reference to British Standard Alloys, the following points are of importance:—

(1) Practically all requirements for cast gunmetals and brasses can be met from the following alloys:—

88/10/2 (B.S. 382-3) and 88/8/4 (B.S. 1021-2), for very special applications.

86/7/5/2 (B.S. 1023-4), for high-grade work.

85/5/5/5 (B.S. 897-8), for general work, but only where a tin-bearing alloy is essential.

Type A Brass (B.S. 1025-6), for general work in place of tin-bearing alloys.

Type B Brass (B.S. 1027-8), for all work where a copper alloy is not required to have any special properties.

(2) The most efficient use of scrap is essential. On no account should the grade of scrap used be of higher quality than that of the alloy in which it is to be incorporated, unless to counterbalance the use of a still lower grade of material.

(3) When insufficient supplies of scrap are available to meet demands virgin material will have to be provided. As far as possible such material must be used only in the highest grades of alloy (*e.g.*, B.S. 382-3, B.S. 1021-2, or 2.B.8 phosphor bronze). Virgin metal or material of comparable quality should preferably be employed in castings of alloys made direct in one melting stage. This releases ingot-making capacity for the production of lower grade alloys from mixed or other scrap of an indefinite composition which requires to be melted in bulk under properly controlled conditions.

(4) B.S. 1025-6, Type A casting brass, has been designed to take care of the lowest grades of scrap unsuitable for the better qualities of wrought products. The aluminium content has been kept low to ensure a good casting material. Elements other than copper and zinc are impurities and are allowed up to the limits stated only to cover such quantities as may be present as impurities in the scrap from which the brass is produced.

(5) B.S. 1027-8, Type B brass, has been designed to take care of the lowest grades of scrap only; principally material more highly contaminated with aluminium, which is allowed as an impurity up to 0.25 per cent. Allowable elements other than copper and zinc are impurities only and must never be added intentionally. If proper care is taken to avoid the contamination and mixing of scrap and swarf the quantity of material available for use in Type B brass should be greatly reduced.

The Institute of British Foundrymen, through its representation on B.S.I. Committees, has assisted in the preparation of the above specifications. The Non-Ferrous Sub-Committee of the Institute's Technical Committee will be pleased to give all assistance to those engaged on the production of these new alloys. Inquiries should be addressed to the Acting Secretary, St. John Street Chambers, Deansgate, Manchester, 3.

Utilisation of Blast-Furnace Gas.—Discussing the economic criteria in the utilisation of blast furnace gas in boiler plant, C. MONTEIL says in "Revue de Métallurgie" that a variety of desiderata have to be met, *e.g.*, partial not complete cleaning of the gas, cooling to remove part of the moisture, heating of the combustion air, the use of suitable burners and appropriate grate design, if a high efficiency is to be attained. The gas can also be used successfully in steam turbines and blowers. In modern designs of gas engines, turbines and boilers, one of the chief aims is to reduce the gas consumption and the cost per kw.-hrs.

WASTE PAPER IS IN URGENT DEMAND

SHEFFIELD BRANCH ACTIVITIES

The May and June meetings of the Sheffield Branch were devoted to lectures and discussions on fuel economy in foundry and heat-treatment plant and on general moulding and casting methods

The summer session of lectures and discussions of the Sheffield Branch of the Institute of British Foundrymen commenced under the presidency of Mr. T. R. Walker on May 21, when Mr. F. Smith (Fuel Department of English Steel Corporation) referred to the need for economy in fuel of all kinds in foundries and heat-treatment plants, drawing upon his recent experiences in visiting smaller works in an advisory capacity to give practical demonstrations of the possibilities of fuel saving without interfering with production. The Paper ("Fuels and Furnaces for the Heat-Treatment of Steel Castings") has been printed in the Journal.

MR. F. E. STEELE said he had made considerable economies by utilising partly spent coke from "dropped bottoms" of cupolas and had found that it had paid to use an elderly employee to riddle the coke from ashes, even the smaller sizes were useful for foundry and core stove fires.

MR. SALMON had found that the mould stove firemen could be interested in fuel economy if they were shown temperature recorder curves and instructed to fire again as soon as the temperature tended to fall away. In this way the correctly spaced firing intervals were maintained and by gradually reducing the firegrate area it was possible to maintain the drying conditions with a minimum fuel consumption. A good discussion followed and Mr. T. R. Walker invited the members to a mass meeting to be held in Sheffield to discuss fuel economy from all angles.

Moulding and Casting Methods

The second meeting of the season was held at the Royal Victoria Hotel on June 12, 1942, when an effort was made to encourage the younger foundrymen to enter into the discussion of methods of moulding and casting in steel, iron and non-ferrous metals. Mr. T. R. Walker presided, and the discussion was opened by MR. W. H. SALMON, who illustrated his remarks by means of lantern slides and who exhibited a number of blueprints and the corresponding wooden models which had been made for the instruction of students attending the Foundry Practice and Science course at Sheffield University. He pointed out that he would refer to the wide difference of selling prices per casting, casting temperatures, melting furnaces and moulding sands used, but the foundryman had to find how to make the casting in the cheapest and most convenient way, and the variations between individual foundries depended on the quantities required and the boxes and labour available. The difference in the casting temperatures of different metals was illustrated by a series of curves for ferrous alloys with increasing carbon content, which showed that carbon steel, manganese steel, white iron (1 per cent. Si) and grey iron (3 per cent. Si) must be cast into sand moulds capable of withstanding casting temperatures above 1,500, 1,400, 1,300 and 1,200 deg. C. (true) respectively. Most non-ferrous alloys (except high nickel alloys) were cast at lower temperatures so that the question of refractoriness of the sand was of lesser importance.

A finer grain size sand was used for cast-iron and copper alloys on account of the extra fluidity of cast iron and brass (or bronze) and using Mr. Walker's suggested specifications for "coarse," "medium" and "fine" silica sands, exhibited iron, steel and brass castings for which these three sands had been used on adjacent portions of the same casting, to show the defects that unsuitable grain size would produce. The main point of sand control was that there was a narrow range of moisture content which gives the best green strength; low moisture gave low green and dry strength; too much moisture gave a falling off in green strength and excessive dry strength which was liable to make the sand too hard after drying. The importance of a correct drying temperature for oil sand, clay-bonded sand and compo was shown by diagrams comparing the dry strength after drying at temperatures up to 700 deg. C. Synthetic sands had become general in steelfoundries and the various advantages were enumerated, such as selected sand, grain size, lower moisture content, lighter milling, less raw materials to transport and store and less spent sand to dump. The A.F.A. sand test results for moulding sands used for various metals were given in tabular form, and it was shown that the main variable was the permeability. The relations between sand properties, mould hardness and defects arising from variations were also tabulated.

Chilling and Fluidity Problems

External chilling was used for different purposes in steel and iron casting. In ironfoundries the object of external chills was to retain the carbon in the combined condition and give surface hardness by regulating the depth of "chill." In steel, the carbon was usually less than ¼ per cent. and was always in the combined condition, so that in steelfoundries, external chills were used to hasten solidification in thicker parts of castings and enable lower proportions of feeder head to be effective. For instance, a 6-in. cube cast in a chill with a sand-lined head could be sound with 15 per cent. of head, whereas a similar cube cast in sand, with a similar head required a head equal in volume to the casting to produce a cast steel cube free from piping.

Probably the most important single factor in the production of sound castings was adequate fluidity, and in iron, steel and aluminium foundries the element which controlled fluidity was silicon. The ease with which grey iron (3 per cent. Si) was cast compared with white iron (1 per cent. Si), and the good casting properties of 12 per cent. Si aluminium alloys were well known.

In addition, high phosphorus content was used to

Sheffield Branch Activities

produce the very fluid cast irons employed for thin rainwater pipes and the like, but high phosphorus could not be used for steel castings, as it reduced the resistance to shock. With regard to steel, the latest American work by Taylor, Rominski and Briggs (A.F.A., September, 1941) was summarised in Fig. 1, which showed the effect of two important variables, namely, casting temperature and steel composition. All the results are compared to a standard composi-

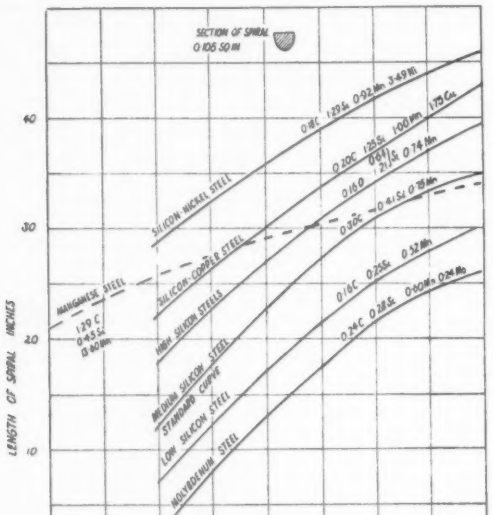

FIG. 1.—FLUIDITY OF STEELS GRAPH. (TAYLOR, ROMINSKI AND BRIGGS, TRANS. A.F.A., 49, 1941, PP. 1-93.)

tion with 0.41 per cent. Si, lower Si, and the presence of 0.25 per cent. Mo, V, or Ti gave inferior fluidity, while increased silicon, copper and nickel gave marked improvements. The exceptional casting properties of silicon-copper steel and nickel steel are well known to steel foundrymen. As a result of their investigations, the American authors devised a steel with 1½ per cent. Si and 3½ per cent. Ni which gave even better fluidity. The physical properties of this steel have not been reported yet, but it is obvious that it will be an excellent steel from the foundry point of view. The fluidity curve for 12½ per cent. manganese steel is interesting, in view of the large quantities of small and intricate castings now being made in this steel, because while Mn steel is more fluid than carbon steel at temperatures up to 1,550 deg. C., it is no more fluid than carbon steel at higher temperatures (1,600 to 1,650 deg. C. true). It is well known that the fluidity of this steel is also improved by increased silicon content. Some of the casting defects arising from lack of fluidity were illustrated, and attention drawn to the effects of the difference in fluidity of basic and acid steels.

It was interesting to notice that in melting both copper alloys and steels, it had been found that oxidation during melting reduced the hydrogen content to safe, low levels, and that copper and iron melts could be easily and thoroughly deoxidised with elements having a higher heat of formation of the oxide. By comparison, aluminium and magnesium

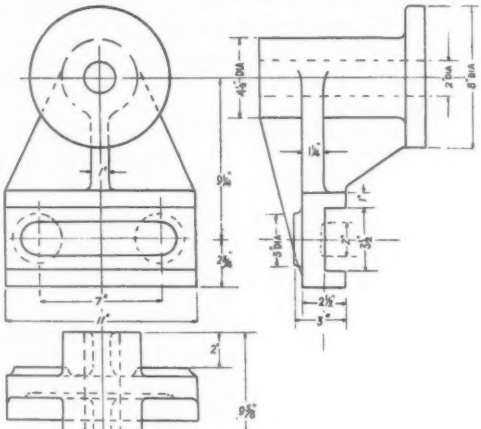

FIG. 2.—CITY AND GUILDS OF LONDON INSTITUTE, QUESTION 1, 1940: "WITH THE AID OF SKETCHES, DESCRIBE THE METHOD OF MAKING THE MOULD, SHOWING THE JOINTS, VENTS, CORES, RUNNERS AND RISERS."

alloys were difficult propositions for the metallurgist, and the founding problem increased because their oxides were heavier than the liquid melt, and therefore were very liable to become entrapped in the stream of metal flowing into the moulds with disastrous effect on the mechanical properties.

Mr. Salmon concluded his introduction to the discussion by saying that the design which had been chosen for that evening (see Fig. 2) was set by the City and Guilds of London Institute examination in 1940, and was selected because it could be moulded in so many different ways, depending on the quantities

(*Continued on page* 350.)

A.F.A. PRE-PRINTS

Available to I.B.F. Members

Through the courtesy of the American Foundrymen's Association, the Institute of British Foundrymen has now received copies of Papers presented to the A.F.A. Annual Convention, 1942. Copies of these Papers are available on loan for short periods to members of the I.B.F., who should make application to the Acting Secretary, St. John Street Chambers, Deansgate, Manchester, 3. Applicants should quote the reference numbers shown.

The Papers available are:—

Non-Ferrous

No. 42-4.—"Tentatively Recommended Practices for Sand-Cast Tin Bronzes." By the Non-Ferrous Division of the A.F.A.

No. 42-29.—"Salvage and Reclamation of Aluminium Alloy Castings by Welding." By A. T. Ruppe and A. J. Juroff.

Cast Iron

No. 42-5.—"Effects of Superheating, Pouring Temperatures and Microstructure on the Elastic Properties of Some Plain and Alloy Cast Irons." By A. I. Krynitsky and C. M. Saeger, jun.

No. 42-8.—"A Metallurgical Study of Cast Iron for Glass Forming Moulds." By W. H. Bruckner and Harry Czyzewski.

No. 42-12.—"Cast Iron Strength v. Structure." By Robert R. Adams.

No. 42-13.—"The Effect of Composition on the Annealing of White Cast Iron." By W. D. McMillan.

No. 42-18.—"Direct Determination of Combined Carbon in Cast Iron and Steel." By J. G. Donaldson.

No. 42-23.—"The Effect of Phosphorus on the Growth of Grey Cast Iron." By M. N. Dastur and Morris Cohen.

No. 42-27.—"Machinable 1.5 per cent. and 2.0 per cent. Chromium Cast Irons to Resist Deterioration at High Temperatures." By C. O. Burgess and A. E. Schrubsall.

No. 42-34.—"Casting Cleaning in a Grey Iron Foundry." By Howard B. Nye.

No. 42-38.—"Effects of Ladle Inoculation on Austenitic Cast Iron." By J. T. Eash.

Steel

No. 42-15.—"The Production of Uniform Steel for a Light Castings Foundry." By C. H. Kain and L. W. Sanders. A.F.A. Exchange Paper. (Also available as an I.B.F. pre-print.)

No. 42-17.—"Making Navy Steel in Basic Electric Furnaces." By S. W. Brinson and F. B. Anderson.

No. 42-20.—"Atmospheric Pressure and the Steel Casting—A New Technique in Gating and Risering." By Howard F. Taylor and Edward A. Rominski.

No. 42-37.—"Studies on Centre Line Shrinkage in Steel Castings." By S. W. Brinson and J. A. Duma.

Malleable Cast Iron

No. 42-1.—"Periodic Malleable Annealing Furnaces." By W. R. Bean and W. R. Jaeschke.

No. 42-2.—"The Principles of Graphitisation." By H. A. Schwartz.

No. 42-3.—"Malleable Annealing in the Dressler or Tunnel-Type Kiln." By R. J. Anderson.

No. 42-7.—Some Effects of Hydrogen on the Time of Malleablisation." By C. H. Lorig and M. L. Samuels.

No. 42-10.—"Atmospheres and the Annealing of Malleable Iron." By R. J. Cowan.

No. 42-11.—"Electric Furnace Annealing of Malleable Iron." By R. M. Cherry.

No. 42-14.—Graphitisation of Arrested Anneal Malleable Iron." By D. P. Forbes.

No. 42-22.—"Temperature Control of Graphitising Furnaces." By J. H. Lansing.

No. 42-44.—"Gating Malleable and ArmaSteel Castings." By F. E. Reeves.

Sands

No. 42-6.—"A Study of the Flowability of Foundry Sands." By Erik O. Lissell and Eugene J. Ash.

No. 42-9.—"The Use of the Hot Strength Test as a Tool for Controlling Core Mixtures." By Fred B. Riggan.

No. 42-16.—Progress Report—"Comparison Data on the Durability of Naturally-Bonded and Synthetic Moulding Sands by the Repeated Pour Test." By Jack CoVan.

No. 42-19.—"The Drying Out of Synthetic Sands." By N. J. Dunbeck.

No. 42-26.—"The Arrangement of Cores, Blowholes and Vents for Blowing Purposes." By R. F. Lincoln.

No. 42-30.—Report of the Sub-Committee on Sintering Test, Foundry Sand Research Committee, 1941-42. By J. B. Caine.

No. 42-33.—"A Sand Control Programme in a Mechanised Malleable Foundry." By D. F. Sawtelle.

No. 42-41.—"Seacoal and Fuel Oil in Moulding Sand." By Elmer C. Zirzow.

No. 42-42.—"The Effect of Resin Binder Additions on the Properties of Moulding Sands." By Emile Pragoff, jun., and C. P. Albus.

General

No. 42-21.—"Statistical Methods as an Aid to the Control of Foundry Operations." By H. H. Fairfield.

No. 42-24.—"Grinding Wheel Cost Control." By Jeff. Alan Westover.

No. 42-25.—"Steel Pouring Refractories in Foundry Practice." By R. H. Stone.

No. 42-28.—"Acid Electric Furnace Slag Control." By John Juppenlatz.

No. 42-31.—"Welding of Medium Carbon Steel Castings by the Metal Arc Process." By S. E. Mueller, A. B. Smith and J. F. Oesterle.

No. 42-32.—"The Use of Job Evaluation in the Application of Time Study." By E. L. Berry and E. A. Berg.

No. 42-35.—"Production of Copper Patterns by Electro-Forming." By A. K. Laukel.

No. 42-36.—"Temperature Measurement of Molten Cast Iron with the 'Rayotube' and Optical Pyrometer." By R. H. Koch and A. E. Schuh.

No. 42-39.—"Lumber for the Patternmaker and Foundryman—Its Grades, Characteristics and the Effect of External Factors." By E. T. Kindt.

No. 42-43.—"Designing for Foundry Production." By Dr. Ernest Geiger.

THE NEW WAR DAMAGE ACT, 1942

The Three Schemes Up-To-Date

The War Damage (Amendment) Act, 1942, alters the original 1941 Act and introduces new provisions, experience having been gained from the operation of the three Governmental insurance schemes: (*a*) The Buildings Scheme (compulsory throughout), which applies to buildings and other immovable property including fixed machinery and plant; (*b*) the Business Scheme (compulsory where the insurable goods exceed £1,000, voluntary otherwise), which applies to movable plant and machinery, office and shop equipment, etc., goods held or used for the purposes of the business, etc.; and (*c*) the Private Chattels Scheme (voluntary throughout), which applies to personal belongings, clothing, furniture, etc.

The Business and Private Chattels Schemes

Immediate payment of compensation under both (*b*) and (*c*) follows if the claim under (*b*) does not exceed £100, under (*c*) £25, and also in any case where it is considered expedient in the public interest that the goods destroyed or damaged should be replaced or repaired, and also if it is thought that undue hardship would result if payment were deferred (this last rule now applies by this new Act to both schemes (*b*) and (*c*) instead of just to (*c*) as formerly). Apart from the foregoing, payment will not be made until after the war (plus 2½ per cent. interest).

In connection with the "public interest" provision as above, it has been found that by a legal flaw in the 1941 Act that, although the Board of Trade could say how the compensation money is to be expended, if it is expended, power was not taken to say that it *must* be expended. By this new Act, the Board can impose conditions requiring that the sum paid shall be applied in or towards the replacement or repair of the goods, or shall be so applied within such time as the Board may specify, and if any condition is not complied with, the money is recoverable at law.

Free cover is given under (*c*) (up to £200 for a householder plus £100 for wife's belongings, £25 each child, £50 for a person not a householder), and where insurable goods under (*b*) do not exceed £100 value, these are insurable under (*c*), and could apply for the free insurance mentioned, and so to this extent free insurance applies to (*b*) likewise. Furthermore, where war damage has occurred before insurance was effected under (*b*) the Board of Trade is now given power to make payments in certain circumstances (details by Regulations), as example if failure to pay premiums was due to war circumstances. Cover above the free limits under (*c*) can be obtained at moderate premiums, the total cover, however, being limited to £10,000.

The Buildings Scheme

This scheme gave cover by the 1941 Acts for the period—*i.e.*, the "risk period"—from September 3, 1939, to August 31, 1942, the contribution being 10s. in the pound of the Schedule A (Income Tax) assessment, payable in five instalments of 2s. poundage on the First of July, 1941-2-3-4 and 5. This new Act now departs from fixed dates, the "risk period" to run indefinitely from August 31, 1942, until such time as terminated by a Treasury Order, and the contribution and instalments are to remain the same as explained above.

If, however, it is estimated (estimates are made from time to time) that the expected receipts will fall short of half of the expected payments, the number of or/and the rate of the instalments can be increased by Treasury Order. On the other hand, if the expected receipts exceed the expected payments, Parliament can decide how the receipts are to be reduced, as for example, one or more of the instalments cancelled.

The Schedule A assessment to apply is that as at September 3, 1939, which in most cases will be that which applies currently, as no increases can be made between general valuations (the general valuation intended for 1941-42 has been postponed until after the war), except where there are structural alterations, additions, etc.; if the Schedule A assessment is lowered, nevertheless the contribution cannot be reduced, the 1941 War Damage Act providing for this, the 1939 figures so applying, but note the following. By this new 1941 Act, if there is a lower Schedule A assessment by reason of the destruction or demolition of buildings, not caused by war damage (*e.g.*, ordinary fire, ordinary demolitions), the new figures will apply for the instalments from 1942 onwards, not for the 1941 instalment however.

If, following war damage, the premises are considered repairable, the compensation is by way of a "cost of works payment," if not considered repairable by a "value payment," but prior to this new Act the War Damage Commission could not make a payment under both rules in respect of the same property, the payment was required to be one or the other. Now they can do so, if the circumstances warrant it, and this power is best shown by an example. A firm may not wish to reconstruct exactly as formerly, say omitting a top floor, erecting premises in place of same elsewhere; the Commission can now allow a "cost of works payment" for the part repaired, and a "value payment" in respect of the part not repaired.

Where the lease is for seven years or less (as well as when owned) the landlord pays the entire contribution; where the lease is longer the contribution is divided between landlord or tenant, the share of same being determined by a formula based on the unexpired term, and the proportion of rent to value, roughly the higher the rent paid, the lower the contribution share of the tenant. Provision is now made so that if the landlord makes a voluntary remission of rent, or no rent is payable by reason of the Landlord and Tenant (W.D.) Acts (*e.g.*, while premises are unfit), the tenant's share cannot be increased. That new provision may favour the tenant, on the other hand another provision may be to the landlord's advantage, as it is now made clear that, where the rent is an inclusive one (landlord responsible for rates, etc., for certain services, etc.), the rent to apply for the formula is to be a sum with appropriate deductions made for the rates, etc.

STANTON

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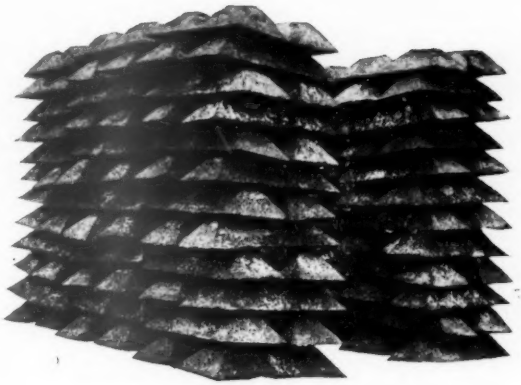

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NEWS IN BRIEF

AFTER AUGUST 24, electric furnaces must not be exported without a licence.

WE OFFER our congratulations to our esteemed contemporary, "The Foundry," on attaining its fiftieth year of publication.

THE PASCALL ENGINEERING COMPANY, LIMITED, have moved from 156, Charing Cross Road, to 114, Lisson Grove, Marylebone, London, N.W.1.

AN ASSOCIATION OF WHOLESALE ENGINEERING DISTRIBUTORS has been formed with offices at 33, West India House, Baldwin Street, Bristol, 1.

THE PREMIER FOUNDRY, Tomswood Hill, Barkingside, Ilford, Essex, has been made into a limited company, and the firm will be known in future as "Devonish & Williams, Limited."

MR. H. BOWES, Northern representative for crucibles and refractories of the Carborundum Company, Limited, Trafford Park, Manchester, died recently. Mr. Bowes joined the company in 1929.

NOTES ON THE ORGANISATION of the part-time employment of women are contained in a new Ministry of Labour pamphlet, "Planning for Part-time Work." Ask at any Ministry of Labour office for pamphlet PL105/1942.

OF THE SHIPYARDS which were closed during the long and severe shipbuilding depression before the war, 23 have been reopened by the Admiralty and are at work as ship-repairing establishments or shipbuilding units.

AN AGREEMENT has been reached between the West of Scotland Steel Employers' Association and the trade unions whereby more than 1,000 maintenance tradesmen will receive an output bonus of 10s., based on a 47-hours week. The advance will be retrospective to April last.

THE ANNUAL REPORT AND ACCOUNTS of Richard Thomas & Company, Limited, for the year ended March 28 last show that the net profit was £42,029 higher at £564,637. A dividend of 5 per cent., against nil last year and the year before, is being paid on the ordinary shares.

THE COMBINED PRODUCTION AND RESOURCES BOARD announces from Washington the appointment of an American Steel Mission to Great Britain in a move to attack this basic war production problem of the two countries on a united basis. It is hoped that a British Steel Mission will go to the U.S.A. to make a similar study there when the American Mission returns.

THE MINISTER OF LABOUR and National Service has made the Essential Work (General Provisions) (No. 2) Order, 1942 (S.R. & O., 1942, No. 1594), consolidating the existing General Provisions Order, the Amendment Order by which absenteeism and persistent lateness were made direct offences, and the Part-time Workers Exclusion Orders, which excluded from the principal Order part-time workers who had entered industry because of wartime conditions.

PERSONAL

MR. H. ORR and MR. H. WRIGHT have been appointed works directors of Ambrose Shardlow & Company, Limited, Sheffield.

MR. A. E. COOK has been appointed managing director of Cravens Railway Carriage & Wagon Company, Limited, Darnall, Sheffield.

MR. J. H. SHARP and MR. F. J. WILKINS have been awarded the William Macnab Medal as a result of the examination for Associate Membership of the Institution of Chemical Engineers.

MR. V. F. STINE has just completed 30 years' service with the Pangborn Corporation, the well-known American manufacturers of shot blast and other foundry equipment. Mr. Stine is the Corporation's sales director.

MR. NOEL HOBBS, an associate member of the London Branch of the Institute of British Foundrymen and son of Mr. W. Hobbs, of the Standard Brass, Iron & Steel Foundries, Benoni, South Africa, has joined H.M. Forces and has been wounded. His present address is Royal Bombay Sappers and Miners, Kirkee, Poona, India.

Will

CAIRD, A. F. R., a director of the Aluminium Casting Company, Limited, Greenock £233,410

BULKING OF MOIST SAND

In the course of a Paper entitled "Concrete Simply Explained," printed in the Transactions of the Society of Engineers, MR. V. S. WIGMORE, the author, recalls the interesting fact that a cubic foot of damp sand containing between 5 and 6 per cent. moisture will weigh less than a cubic foot of dry sand. This is due to what is known as "bulking," the increase in volume amounting to between 25 and 33 per cent., caused, it is thought, by the surface moisture on each particle of sand keeping it farther away from the surrounding particles. Any increase in moisture above 5 or 6 per cent. reduces the volume until, when the sand is saturated, it assumes practically the same volume as dry sand, due to the water acting as a lubricant, allowing the grains to nestle closer to each other just as they do when the sand is dry. The fineness of the sand affects the increase in volume; the finer the sand the more it will bulk, says Mr. Wigmore.

COMPANY NEWS

(Figures for previous year in brackets.)

Head, Wrightson & Company—Final dividend on the ordinary shares of 3½% (same).

Ward & Goldstone—Net profit for year to March 31, after providing for taxation, £59,995 (£49,069); dividend on the ordinary stock of 20% (same).

W. G. Allen & Sons (Tipton)—Net profit for the year ended March 31, after depreciation and taxation, £8,428 (£7,312); to general reserve, £2,000; dividend of 10%, £6,140; forward, £6,270 (£5,982).

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G.P. 152

Raw Material Markets

IRON AND STEEL

Ironfoundries continue to be somewhat variably employed. Manufacturers of heavy products, generally speaking, are as active as the capacity of their plant permits, being engaged almost solely on the production of castings for Government departments. Many light foundries, on the other hand, have little business on their books, although a few have been able to maintain a satisfactory rate of working. The building trade, of course, is slack, and as the light-foundry trade depends to a large extent on orders from this source, the quiet conditions in building have reacted unfavourably on the foundries. While civil building operations are almost entirely suspended, there is a moderate flow of specifications from the Government in connection with the erection of Army hutments, etc.

Foundrymen are getting quite liberal supplies of raw materials and, all things considered, the position in this respect is not unsatisfactory. Certainly many foundries are utilising grades of iron which in normal times they would not consider, but it is extremely gratifying that they are procuring good results. The raw materials situation has changed materially since the outbreak of war; the shipping question has enforced the curtailment of imports of foreign ores, while Axis territorial gains have also adversely affected supplies of ore. Thus, it has been necessary for consumers to rely increasingly on home-produced, high-phosphorus iron. This grade was always used extensively in the light-castings foundries, but now it is being taken up quite freely for use by the heavy engineers, who cannot obtain all the better-quality irons they need. Hematite particularly is in short supply and is, in fact, withheld from consumers except where its use is considered to be imperative by the Control authorities. Foundries are also using refined iron and steel scrap to make good the deficiency of recognised foundry irons.

Production of iron and steel during the month of August is bound to show a small recession, as holidays are being taken at the producing works; the opportunity is also being taken to carry out repairs and overhauls which have been made necessary by the strain of continuous activity over a long period. The loss of output this month should not be a serious matter, however, as consumers, too, are snatching a few days for holidays and repairs, so that consumption will be lower for a time. The breaks at both producing and consuming works are due more to the advisability of overhauling plant than to the workers' demands for rest periods, and it cannot be too strongly emphasised that the employees in the iron and steel industry have been most generous and conscientious over the matter of holidays.

With good stocks of coke on the ground at most foundries, the position in this respect is eminently satisfactory. The coke ovens have plentiful supplies available for distribution, and most of the larger consumers have taken full advantage of this to stock up to capacity in preparation for the coming winter. Durham best foundry coke is changing hands at 69s. 3d. per ton, delivered Birmingham and Black Country stations: this price is controlled and subject to revision at any time, so that all forward business is negotiated on the basis of a rise-and-fall clause which is inserted in all contracts to safeguard both producers and buyers.

A certain amount of time is being lost at the moment by the steelworks, many of which are closing for short periods for holidays and repairs, but, apart from this factor, very active conditions are maintained in most departments. Light structural steel continues to be absorbed in large tonnages, and there has lately been an improved call for heavy joists and sections. Plates, chiefly for the shipbuilders, tank and boiler makers, are in sustained request, while all types of alloy and special carbon steels are promptly moved into consumption, armament and munition factories absorbing the bulk of the outputs. The latter are also calling for heavy quantities of special quality sheets, cold-rolled strip and bright-drawn steel bars. Common black sheets are in rather stronger demand than they have been in recent weeks.

NON-FERROUS METALS

Ample supplies for all essential work; none for purposes which do not, directly or indirectly, assist in the prosecution of the war—that, in brief, is the supply situation in the non-ferrous metals trade to-day. Consumption is very large indeed, but production and distribution are so organised as to ensure that the vital needs of the war industries and essential home services are fully met.

The United Nations have ample supplies of copper at their disposal, and the only threat to the maintenance of a free flow of the metal comes from the submarine attacks against British, American and allied shipping. This threat, though serious, and directed against all commodities which have to be carried across the seas, is being met, and no phase of the war effort is being held up because of a lack of copper—no mean achievement in view of the enormous consumption of the metal.

As in the case of copper, extensive supplies of lead and spelter are at the disposal of the United Nations, despite the loss of Burmese supplies. The shipping situation, however, dictates caution in the use of all metals, and lead and zinc are supplied only against licences and for essential purposes. Rigid economy rules are laid down by the authorities in the case of zinc particularly, for much of our supply has to be brought from the Antipodes.

In the case of tin, there is obvious need for exercising the most careful control over supplies, owing to the loss of the Malayan production. The tinplate makers have been called upon to make the greatest saving, for they are normally the largest users, but considerable economies have been secured in other directions also, for example, in the manufacture of bearing metals.

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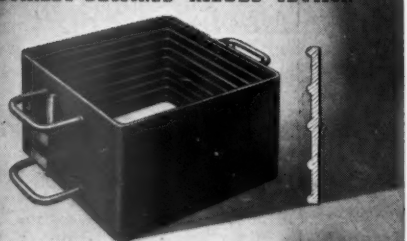

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Participating Associations : British Bath Manufacturers' Association ; British Ironfounders' Association ; British Malleable Tube Fittings Association; Cast Iron Axlebox Association ; Cast Iron Chair Association; Cast Iron Heating, Boiler and Radiator Manufacturers' Association; Cast Iron Segment Association ; Greensand Pipe Founders Association of Scotland; Ironfounders' National Confederation ; National Association of Malleable Ironfounders ; National Ingot Mould Association ; National Ironfounding Employers' Association; Agricultural Engineers' Association (affiliated) ; British Cast Iron Research Association (affiliated); British Grit Association (affiliated); Institute of British Foundrymen (affiliated).

INSTITUTE OF BRITISH FOUNDRYMEN

PRESIDENT, 1941-42 : Major R. Miles, M.Eng. Head Wrightson & Company, Limited, Thornaby-on-Tees.

LIST OF SECRETARIES—

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